Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)
	)
Amendment of Part 18 of the Commission's	)
Rules to Update ISM Regulations	)
And Promote Deployment of New,	)
High Bandwidth Communications Devices	)

PETITION FOR RULEMAKING

Millimeter Wave Communications Working Group

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SUMMARY

The Millimeter Wave Communications Working Group (the "MWCWG") is an industry committee that was formed in response to the Commission's Second Notice of Proposed Rulemaking on radio operation above 40 GHz. Members of the group are: HRL Laboratories, Apple Computer, Sun Microsystems, Hewlett-Packard Company, Motorola, Metricom, Rockwell International and Eaton Division of Cutler Hammer.

The MWCWG's mission was to develop a spectrum etiquette to govern operation in the 59-64 GHz unlicensed band, in order to promote the efficient use of the band without unnecessarily constraining the development of new millimeter wave unlicensed products and services. In July 1998, the Commission adopted the MWCWG's proposed etiquette.

Currently, the MWCWG companies are working to develop a wide variety of products that will provide very high speed, low cost communications using the 59-64 GHz unlicensed band. Applications may include wireless local-area networks, digital video links, position sensors, and short range wireless point-to-point and point-to-multipoint data links. The MWCWG's members' efforts have given them an understanding of the opportunities presented by the 59-64 GHz band, but also an understanding of the technical and market factors that could constrain their ability and the ability of users to realize the band's potential.

In particular, the MWCWG's members have concluded that the widespread deployment of ISM devices in the 61.0-61.5 GHz band will threaten the successful operation of communications devices in the 59-64 GHz band unless these ISM devices meet reasonable in-band emission limits. As a result, the MWCWG respectfully requests that the Commission require 61 GHz ISM devices to meet the same in-band emission limits that are required for 60 GHz unlicensed communications devices.

The MWCWG is requesting only that the Commission adopt limits on the emissions associated with 61 GHz ISM devices. The MWCWG is not requesting that the Commission regulate the operating power of ISM devices or that the Commission adopt any new regulations for ISM devices operating

in other ISM bands. Finally, the MWCWG is not proposing that the Commission take on any new equipment authorization responsibilities or subject ISM manufacturers to any new equipment authorization requirements.

The action that is being proposed by the MWCWG will promote the development of very high bandwidth communications devices. It is consistent with the conditions under which the 61.25 GHz band was made available for ISM use and can be achieved without imposing undue hardship on ISM users. As a result, a grant of this Petition would serve the public interest.

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PETITION FOR RULEMAKING

The Millimeter Wave Communications Working Group (the "MWCWG") requests that the Federal Communications Commission (the "Commission" or "FCC") amend Part 18 of its rules to harmonize the in-band emission limits applicable to Industrial, Scientific and Medical ("ISM") devices operating in the 61.0-61.5 GHz band with those that govern unlicensed devices operating in the 59-64 GHz band.[1]

THE INTEREST OF THE MWCWG

The MWCWG is an industry committee that was formed in response to the Commission's Second Notice of Proposed Rulemaking on radio operation above 40 GHz.[2] Members of the group are: HRL Laboratories, Apple Computer, Sun Microsystems, Hewlett-Packard Company, Motorola, Metricom, Rockwell International and Eaton Division of Cutler Hammer.

The MWCWG's mission was to develop a spectrum etiquette to govern operation in the 59-64 GHz unlicensed band, in order to promote the efficient use of the band without unnecessarily constraining the development of new millimeter wave unlicensed products and services. On December 13, 1996,

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[1] The FCC recently adopted a spectrum etiquette for the 59-64 GHz unlicensed band and finalized the technical rules that will govern operation within this band. *Amendment of Parts 2, 15 and 97 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications*, Third Report and Order, 13 FCC Rcd 15074, ¶ 11 (1998) ("Above 40 GHz Third R&O"). The MWCWG's recommended rule changes, set forth in Appendix A, reflect these new rules.

[2] *Amendment of Parts 2, 15 and 97 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications*, First Report and Order and Second Notice of Proposed Rule Making, 11 FCC Rcd 4481 (1995) ("Above 40 GHz First R&O").

after nearly one year of work, the MWCWG submitted its proposed spectrum etiquette to the Commission. In July 1998, the Commission adopted the MWCWG's proposed etiquette.[3]

Currently, the MWCWG companies are working to develop a wide variety of products that will provide very high speed, low cost communications using the 59-64 GHz unlicensed band. Applications may include wireless local-area networks, digital video links, position sensors, and short range wireless point-to-point and point-to-multipoint data links. The MWCWG's members' efforts have given them an understanding of the opportunities presented by the 59-64 GHz band, but also an understanding of the technical and market factors that could constrain their ability and the ability of users to realize the band's potential.

In particular, the MWCWG's members have concluded that the widespread deployment of ISM devices in the 61.0-61.5 GHz band will threaten the successful operation of communications devices in the 59-64 GHz band unless these ISM devices meet reasonable in-band emission limits. As a result, the MWCWG respectfully requests that the Commission require 61 GHz ISM devices to meet the same in-band emission limits that are required for 60 GHz unlicensed communications devices.

The MWCWG wishes to stress at the outset of this Petition that it is requesting only that the Commission adopt limits on the emissions associated with 61 GHz ISM devices. The MWCWG is not requesting that the Commission regulate the operating power of ISM devices. It is not requesting that the Commission adopt any new regulations for ISM devices operating in other ISM bands. Finally, it is not proposing that the Commission take on any new equipment authorization responsibilities or subject ISM manufacturers to any new equipment authorization requirements.

The action that is being proposed by the MWCWG will promote the development of very high bandwidth communications devices. It is consistent with the conditions under which the 61.25 GHz band was made available for ISM use and, it is the belief of the MWCWG, it can be achieved

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[3] Above 40 GHz Third R&O, *supra* n.1, at ¶¶10-11.

without imposing undue hardship on ISM users. As a result, a grant of this Petition would serve the public interest.

BACKGROUND AND DISCUSSION

While ISM devices and communications systems often are able to operate harmoniously in shared spectrum, at times the needs of the communications and ISM users diverge. Changes in spectrum allocations, the introduction of new radio technologies, and the development of new types of ISM equipment each can give rise to a situation in which review and reconsideration of the existing ISM rules is appropriate.[4] Such a situation currently exists with respect to the 61 GHz ISM band.

I. INTERFERENCE FROM ISM DEVICES COULD JEOPARDIZE THE DEVELOPMENT OF THE 59-64 GHz UNLICENSED BAND.

The Commission's recent effort to open the millimeter wave bands to commercial development has created a situation meriting review of certain existing ISM rules. As part of its millimeter wave proceeding, the Commission, in 1995, made the 59-64 GHz band available for use by general unlicensed wireless devices.[5] This band consists of a spectrum block of contiguous frequencies of unparalleled size which promises to play an important role in expanding the range of low-cost, flexible products available to communications users.

The 59-64 GHz unlicensed allocation will make possible a host of short-range communications applications, operating at higher speeds and at lower cost than could be achieved using any other spectrum. In turn, development of the 59-64 GHz band will foster the creation and growth of new industries, promote job creation, stimulate the development of new services for consumers, facilitate technology transfer from the military sector, and promote national competitiveness by enabling the development of

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[4] *Overall Revision of the Rules Regarding Industrial, Scientific and Medical (ISM) Equipment*, Third Report and Order, 58 Rad. Reg. 2d (P&F) 1096, ¶1 (1985) ("1985 ISM NPRM"); see, e.g. *1998 Biennial Regulatory Review – Amendment of Part 18 of the Commission's Rules to Update Regulations for RF Lighting Devices*, Notice of Proposed Rulemaking, 13 FCC Rcd 11307 (1998) ("1998 ISM NPRM").

[5] Above 40 GHz First R&O, *supra* n.2, at ¶ 33.

technology for potential use in other parts of the world.[6] As the Commission recognized in its allocation order, this block of frequencies "offers the greatest potential for allowing the development of short-range wireless radio systems with communications capabilities approaching those now achievable only with coaxial and optical fiber cable."[7]

The potential of the 59-64 GHz band is so significant and unique because in this allocation the Commission granted unusually large bandwidth and freedom from almost all existing uses. Indeed, the Commission refused to permit vehicular radar devices to operate in the 60-61 GHz band because such use effectively would divide the 59-64 GHz unlicensed band into two substantially less useful segments.[8]

Unfortunately, however, ISM use of a 500 MHz band, centered in the middle of the 59-64 GHz unlicensed band at 61.25 GHz, threatens to undercut the opportunities offered by the 59-64 GHz band in much the same way as did the proposal to permit vehicular radars to operate in the 60-61 GHz band. Although ISM devices have the potential to operate at very high power levels, under existing rules ISM devices operating in the 61.25 GHz ISM band are free from any limits on their in-band emissions.[9] As a result, unless the Commission takes prompt action, potential users of the 59-64 GHz unlicensed band face the prospect of unconstrained deployment of ISM devices with unlimited and unpredictable emissions.

Uncontrolled emissions from ISM devices could render unlicensed devices unreliable or deny them use of the 61.0-61.5 GHz band and adjacent frequencies altogether. If ISM emissions interfere with unlicensed devices, their use effectively will divide the 59-64 GHz unlicensed band into two much less useful segments. In doing so, the only contiguous 5 GHz of bandwidth available, or ever likely to be available, will have been destroyed for short-range, unlicensed broadband communications.

Indeed, even the threat of ISM interference could thwart the development of high bandwidth unlicensed devices if it undermines

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[6] See id. at ¶ 2.
[7] Id. at ¶ 14.
[8] Id.
[9] See 47 C.F.R. §§ 18.301, 18.305(a).

manufacturers' or consumers' confidence in the robustness of reliability of unlicensed devices operating in this band and thereby, prevents investment in these devices. Consequently, investment in the development of these products could be reduced or prevented entirely.

II. THE 61.25 GHz ISM BAND IS UNIQUE AND, THEREFORE, IN-BAND EMISSIONS LIMITS ARE WARRANTED SOLELY FOR THIS BAND.

A. The Proposed Rules Are Consistent With The Commission's Traditional Approach To Regulating ISM Devices.

The MWCWG recognizes that, traditionally, the Commission and the international community have resisted imposing unnecessary regulations on ISM devices. However, for more than half a century the Commission has regulated ISM devices where such action is appropriate to serve the public interest and promote efficient spectrum use.[10]

For example, the Commission's rules already regulate out-of-band emissions by ISM devices.[11] While the Commission does not actively enforce these limits, they remain in effect and could form the basis for an interference complaint.

The Commission also has never ruled out the possibility of imposing in-band limits on ISM devices. Indeed, it recently requested comment on whether in-band limits should be imposed on RF lighting devices in order to protect mobile satellite service operations in the 2.4 GHz band.[12]

When the Commission has declined to adopt in-band ISM limits, its decisions have reflected a balancing of the needs of the ISM and communications communities and a prediction about the potential for interference by ISM devices.[13] Importantly, the Commission has never expressly or implicitly granted to ISM users any "right" to unfettered

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[10] The Commission first adopted rules governing ISM emissions in 1946, in order to protect radiocommunication services from receiving interference from the operation of ISM equipment. See, e.g., 1985 ISM NPRM, *supra* n.4, at ¶ 1.

[11] 47 C.F.R. § 18.305(b).

[12] See 1998 ISM NPRM, *supra* n.4, at ¶ 13.

[13] See, e.g., *Allocation of Spectrum Below 5 GHz Transferred From Federal Government Use*, Fourth Report and Order, 11 FCC Rcd 13657, ¶ 34 (1996).

operation within the ISM bands or any entitlement to unlimited in-band emissions.

The need to impose reasonable limits on ISM devices — including, where necessary, in-band limits — is a reflection of increasing spectrum scarcity and the consequent need to ensure that all spectrum users share this resource responsibly. It is not a departure from past Commission practice, nor does it unfairly or unreasonably intrude on the rights of the ISM community.

B. In Making The ISM Allocation At 61.25 GHz, International Authorities Recognized And Acted Upon The Need To Protect Communications Devices From ISM Interference.

Even if ISM users historically had been granted an entitlement to remain free from in-band emission limits, the technical characteristics and regulatory history of the 61.25 GHz ISM band are fundamentally different from those that characterize other ISM bands. As the 61.25 GHz band's technical characteristics and history make clear, in-band ISM limits not only are permissible but always have been anticipated for this spectrum.

In the lower bands, ISM operation effectively has been made "primary," and communications devices have been granted access to the ISM bands on the condition that they accept any interference caused by ISM applications.

In contrast, the 1979 World Radiocommunication Conference ("WRC-79") authorized ISM use of the 61.25 GHz band "only on the condition that limits of radiation from [ISM] equipment be specified within the bands newly designated for worldwide use and outside all bands designated for ISM equipment."[14]

The relevant footnote to the Table of Frequency Allocations reflects the principle that ISM use of the 61.25 GHz band must provide reasonable protection to communications uses of these and adjoining frequencies. It states:

> "The band 61-61.5 GHz (center frequency 61.25 GHz) is designated for industrial, scientific and medical (ISM)

[14] WRC-79, Resolution 63.

> applications. The use of this frequency band for ISM applications shall be subject to special authorization by the administrations concerned in agreement with other administrations whose radiocommunication services might be affected. In applying this provision administrations shall have due regard to the latest CCIR Recommendations."[15]

This footnote stands in sharp contrast to the footnotes for the more traditional ISM bands, which provide priority to ISM use and require communications devices sharing the bands to accept any interference caused by ISM devices.[16]

When the FCC added the 61.25 GHz ISM band to the domestic Table of Frequency Allocations, it recognized the possible need for in-band ISM emission limits.[17] While the Commission did not immediately adopt such emission limits, this was due to the fact that the interference potential of ISM devices was then under study and, in the Commission's view, it would have been premature to adopt such limits.[18] As a result, the Commission decided to apply only the existing ISM limits to the 61.25 GHz ISM band pending further developments.[19] The Commission made clear, however, that in-band emission limits for ISM devices could be adopted in the future if technical studies demonstrated that such a step would be in the public interest.

The international community is now poised to take further steps to implement the basic condition on which ISM devices have been given access to the 61.25 GHz band. The International Telecommunications Union ("ITU") Radiocommunications Study Group 1 has adopted a new Study Question, co-authored by the Commission, which focuses specifically on spectrum sharing by ISM and short range communications applications at 61.25 GHz. The Study Question recognizes that the short range communications industries are developing systems and devices that are intended to operate in the 59.3-64 GHz band; that there is concern that "future developments of ISM devices...might cause interference to these

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[15] 47 C.F.R. § 2.106 n.911 (emphasis added).
[16] E.g. 47 C.F. R. § 2.106 nn. 707, 752, 806.
[17] See *Overall Revision of the Rules Regarding Industrial, Scientific and Medical (ISM) Equipment*, Third Notice of Proposed Rulemaking, FCC 84-578, 49 Fed. Reg. 47628, ¶ 5 (1984).
[18] See id. at ¶¶ 9, 11.
[19] See id.

communications;" and that the applicable footnote to the Radio Regulations' Table of Frequency Allocations envisions the adoption of regulations designed to protect communications devices from ISM interference. In this context, the Study Question proposes to initiate a study of the possible ways to achieve compatibility between unlicensed communications devices operating in the 59.3-64 GHz band and ISM devices operating at 61.25 GHz.[20]

III. IN-BAND EMISSION LIMITS CAN BE ADOPTED WITHOUT IMPOSING UNREASONABLE BURDENS ON ISM USERS.

There is little or no ISM use of the 61.25 GHz ISM band, other than a few experimental programs, at this time. To the best of our knowledge, no ISM products that operate within this band have been offered for sale.

As a result, the prompt adoption of ISM emission limits would not impose an unreasonable burden on the ISM community. Manufacturers could design new ISM devices with a clear understanding of the technical limits they must meet, by reducing emissions, shielding their high power regions, or undertaking other measures as appropriate. Consequently, both the ISM and Part 15 communities would be freed from the uncertainty that currently clouds prospective use of the 61.25 GHz band. In contrast, deferring action of the core question raised by the MWCWG in this Petition would result in continuing uncertainty for both ISM and communications users.

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[20] See "Compatibility Between Short Range Communication Devices Operating in the Band 59.3-64 GHz and Industrial, Scientific and Medical (ISM) Devices Operating in the Band 61.-61.5 GHz," Study Question ITU-R, Radiocommunication Study Group 1, Munich, July 1998. The work being done at the international level is important in that it evidences broad consensus about the need to protect 60 GHz communication devices from unwarranted ISM interference. The United States, however, is unique, both in the progress it has made in paving the way for commercial use of the millimeter wave bands and in its adoption of a single, mandatory spectrum etiquette to govern communications use of the 59-64 GHz band. In light of these unique domestic considerations, the FCC should not wait for final international action before adopting domestic restrictions on 61 GHz ISM emissions.

IV. THE COMMISSION SHOULD IMPOSE THE SAME IN-BAND EMISSION LIMITS TO 61. 25 GHz ISM DEVICES AS APPLY TO THE 59-64 GHz GENERAL UNLICENSED DEVICES.

A. Uniform Emission Limits Are Necessary To Promote Efficient Spectrum Use And Achieve The Commission's Objectives In Its Millimeter Wave Proceeding.

The Commission's recent decision adopting spectrum etiquette for the 59-64 GHz band recognized the benefits that clear, uniform "rules of the road" have in maximizing efficient and productive spectrum use. As the Commission stated, properly designed, minimally burdensome technical rules are the best means for maximizing the number of users, minimizing the potential for interference, and accelerating the development of low cost devices, without hampering the development of new products and services.

The 59-64 GHz band is unusual among Part 15 bands in that *all* communications devices operating in this spectrum must comply with a single etiquette.[21] As the MWCWG concluded in drafting the etiquette and the Commission confirmed in adopting the etiquette, this uniformity is crucial to the full productive use of the 59-64 GHz band.

Yet while communications devices must operate within a single set of limits, ISM devices currently are free from such limits. Despite the fact that there are legal and regulatory policies that justify distinguishing between Part 15 unintentional radiators, Part 15 intentional radiators, and ISM devices, from a technical perspective the differences are immaterial. Emissions from any device are equally able to cause objectionable interference to communications devices. Indeed, it is precisely for this reason that the Commission historically has imposed out-of-band emission limits on ISM devices and in-and-out of band emission limits on Part 15 unintentional radiators.

In order to preserve the uniform protections intended by the adoption of a spectrum etiquette, the Commission should take the additional step of setting the same emission limits on ISM devices operating in the 61.25 GHz band that must be met by communications devices operating at 59-64 GHz.

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[21] See 47 C.F.R. §§ 15.205(a), (d)(4), 15.255.

Only by taking this step can the Commission ensure that all emissions — whether from communications or non-communications devices — are similarly limited and, thus, prevent the bifurcation and possible obstruction of the 59-64 GHz band.

B. Limits Should Be Imposed Only On ISM In-Band Emissions: No Limits Should Be Placed On ISM Generated Power.

In this Petition, the MWCWG requests that the Commission limit the in-band emissions of ISM devices. It does not, however, propose that the Commission regulate in any way the actual operating power of ISM devices. Under the rules proposed by the MWCWG, ISM manufacturers would continue to be free to decide what power level to use within a device and would be required only to use shielding or another similar approach to limit the device's radiated power.

A well-known example of shielded ISM equipment is the common household microwave oven. In these devices, generated power of the order of 1 kW produces less than 1 mW/cm^2 of emissions as measured 5 cm from the door of the oven.

The MWCWG proposes that 61 GHz ISM devices emit no more than 10 W EIRP average, 20 W peak. For example, an ISM device with 1 Megawatt of generated power would need shielding capable of 50 dB isolation between the active area and the environment. Careful design should be capable of providing this shielding. In the event that a particular piece of equipment can not, by itself, meet the proposed requirement, external shielding can, and should, be constructed for the safety of workers and the protection of the RF environment.

The MWCWG also does not seek any modification of the Commission's existing limits on ISM out-of-band emissions. The out-of-band emission limits presently prescribed in 47 C.F.R. § 18.305(b) should be adequate with respect to most ISM devices. For ultra high-power ISM devices, the MWCWG believes that shielding installed for the purposes of limiting in-band emissions should be adequate to reduce out-of-band emissions to a tolerable level for all communications bands and, therefore,

that it is unnecessary for the Commission to adopt additional special limits for out-of-band emissions of 61.2 GHz ISM devices.

V. ADOPTION OF THE MWCWG'S PROPOSAL WILL NOT REQUIRE ANY CHANGE TO THE COMMISSION'S EXISTING EQUIPMENT AUTHORIZATION RULES.

While the MWCWG strongly urges the Commission to impose reasonable in-band emission limits on 61 GHz ISM devices, it does not propose that the Commission adopt any new ISM equipment authorization requirements to enforce these limits. If a device currently need not be approved by the Commission before it is marketed or sold, it would continue to require no Commission approval.

Under the MWCWG's proposal, implementation of the in-band limits would occur primarily through manufacturer compliance with the limits. Commission "enforcement" would occur only if a interference complaint was filed and found to be valid. As a result, the adoption of in-band ISM emission limits would impose only a minimal incremental burden on the Commission and on manufacturers of ISM devices.

CONCLUSION

Nineteen years ago, when ISM use of the 61.25 GHz band first was authorized, the international community recognized that reasonable emission limits should be imposed on ISM devices in order to ensure that the millimeter wave bands also remain available for use by communications devices.

The last several years have seen a dramatic shift in the prospects for near-term commercial use of the millimeter wave bands. The FCC's efforts in Docket No. 94-124, technical innovations, manufacturers' efforts, and international developments all have combined to make commercial use of the bands above 40 GHz not only foreseeable, but imminent. As a result, there is renewed focus on the need to resolve the question of ISM/Part 15 sharing and a new sense of urgency in giving effect to the basic conditions upon which ISM devices were allowed into the 61.25 GHz band.

In light of these developments, the time has now come for the FCC to impose reasonable in-band emissions limits on ISM devices emitting in the 61.25 GHz band. Specifically the Commission promptly should amend Part 18 of its rules to harmonize the emission limits applicable to ISM devices operating in the 61.0-61.5 GHz band with those that govern unlicensed devices operating in the 59-64 GHz band. By taking this step, the Commission will minimize interference for unlicensed millimeter wave communications devices and, thereby, advance its effort to encourage the commercial development and use of the frequencies above 40 GHz.

Respectfully submitted,

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Attachment 1
PROPOSED RULE CHANGES

Title 47 of the Code of Federal Regulations, Part 18, is amended to read as follows:

1. The authority citation for Part 18 continues to read as follows:

AUTHORITY: Sec. 4, 401, 302, 303, 304 and 307 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154, 301, 302, 303, 304 and 307, unless otherwise noted.

2. Section 18.305, paragraph (a), is amended to read as follows:

Section 18.305 Field Strength Limits.

(a) ISM equipment operating on a frequency specified in § 18.301 is permitted unlimited radiated energy in the band specified for that frequency, except as provided in paragraph (d) of this section.

* * * *

3. Section 18.305 is amended by adding paragraph (d) thereto:

Section 18.305 Field Strength Limits.

* * * *

(d) The field strength limits for ISM devices operating in the 61.0-61.5 GHz band shall not exceed the emission levels set forth in Section 15.255(b)(1) of this Part and shall comply with the limits on spurious emissions set forth in Section 15.255(c)(3)-(4). The field strength limits shall be measured in accordance with Section 15.255(b)(4)-(5) of this Part.